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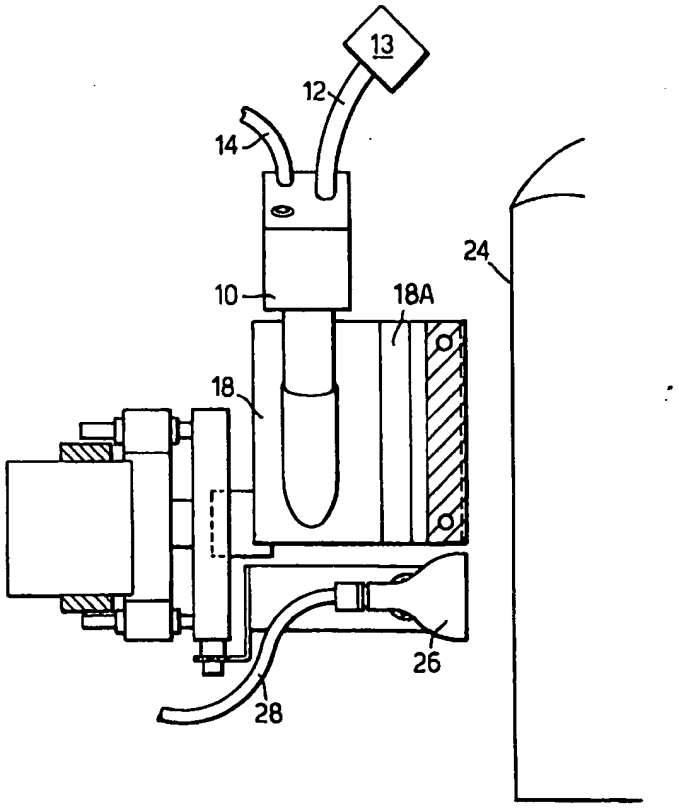
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(54) Title: PACKAGING MACHINE

(57) Abstract

A VFFS (vertical form, fill and seal) packaging machine, in which a web of bag-forming material (23) is driven downwards at a cyclically varying speed around a former (24) to overlap the edges of the web, and including a hot air device (10) for directing hot air onto the overlapping edges so as to seal them, characterised in that the hot air device (10) is supplied with air by a variable-speed blower (13) which automatically varies the velocity of the hot air directed towards the edges of the web, depending upon the speed of the web.



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Packaging Machine

This invention is concerned with packaging machines of the type commonly referred to as a VFFS (vertical form, fill and seal) packaging machine. An example of such a machine is described in British patent specification No. 2056940. That specification describes a machine of the type in which horizontal seals are formed intermittently and in which the tube of bag forming material is accordingly fed intermittently. The present invention is concerned particularly (though not exclusively) with a machine of the type described in which the bag-forming material is fed continuously or substantially continuously, and in which each horizontal seal is formed by a pair of cooperating sealing jaws which move with the bag material while forming the seal and usually also while forming a horizontal cut to separate successive bags.

In a continuous motion machine, the horizontal seals may be formed by cooperating rotary sealing jaws (or rotary double jaws forming two seals during each revolution) or by cooperating sealing jaws which move in a constant orientation along a D-shaped path so as to remain in contact with the bag material while moving through a predetermined straight-line path during which each seal is formed. The present invention is more particularly concerned with machines including such D-motion sealing jaws.

The longitudinal seam by which the edges of a web forming the tube are joined may be achieved in various ways. In the past use has been made of heated bands and there has also been a proposal according to which hot air could be used to form the heat seal with suitable packaging material of which an example is polythene. A prior proposal involving the use of hot air is described in US patent specification No. 5,466,326.

According to the present invention, in a machine of the type described, the web of bag-forming material is driven downwards at a cyclically varying speed around a former to overlap the edges of the web (in simple overlap fashion or to form a butt joint), and the means for sealing the overlapped edges longitudinally comprises a hot air device for directing hot air onto the overlapping edges so as to seal them, characterised in that the hot air device is supplied with air by a variable-speed blower which automatically varies the velocity of the hot air directed towards the edges of the web, depending upon the speed of

the web.

Downstream of the hot air device there is preferably means for blowing cool air onto the seam to set the seal.

The web speed is varied cyclically in a controlled manner in order to allow control of the bag length. For the same purpose, the speed of the sealing jaws is preferably also varied cyclically. During each cycle, between successive sealing operations, the web speed may be increased to increase the bag length and/or the speed of the sealing jaws may be decreased to increase the bag length. In practice a range of bag lengths may be achieved by suitable control of the speed patterns of both the web and the sealing jaws, the only essential criterion in a continous-motion machine being that the speeds should be equal while the sealing jaws are in contact with the bag material.

The speed of the hot air blower may be stepped between two levels, one corresponding to the speed of the web during sealing, and the other to the speed or average speed of the web between successive sealing operations. Preferably, however, the blower is driven by a variable speed motor which is continuously controlled by an inverter control circuit in response to the speed of the web.

This invention enables a substantially uniform longitudinal seam to be formed, notwithstanding variations in the speed of the bag-forming material.

The air heating section of the hot air gun is preferably maintained at a substantially constant but adjustable temperature. In contrast, the disclosure of US patent 5,466,326 is based on control of the heating element temperature and is not believed to be practically capable of achieving as uniform a seam as can be achieved by the present invention. The reason for this is that the temperature of a heating element cannot be rapidly altered to allow the hot air temperature to track the speed of the web. Alternatives described in US patent 5,466,326 are also not believed to be as satisfactory as the present invention in terms of allowing rapid control of the air sealing operation in response to web speed. Furthermore, the application of cool air, preferably in the form of a thin film of air, is believed to be important, though other means of cooling the seam may alternatively be substituted.

An example of a longitudinal seam forming arrangement according to this invention is shown in the accompanying drawings. In

these drawings:

Figure 1 is a side view of the hot and cold air blowing arrangements;

Figure 2 is a view from the right of Figure 1, showing the nozzles through which hot and cold air are blown; and

Figure 3 is a plan view of part of the apparatus.

Figure 1 shows a hot air gun 10 into which air is blown through a duct 12 by a suitable blower represented diagramatically as item 13. Power is supplied to the gun 10 by a cable 14, and the gun includes a temperature adjuster 16.

Hot air from the gun 10 enters a hollow body 18 having a side outlet formed by converging walls 18A and 18B (see particularly Figure 3) leading to a narrow nozzle portion formed by closely spaced parallel walls 20 and 22 (see Figure 2). The walls 20 and 22 may be spaced apart, for example, by 2mm or less. A hot air jet is thus directed from the nozzle towards the overlapping edges of a web of packaging material 23 formed into a tube around a cylindrical former 24 (Figure 3), the overlapping edges being in the region 23A.

Immediately after passing the hot air nozzle, the seam is secured by a film of cool air directed towards it by a nozzle 26 supplied with cool air via a tube 28. As shown in Figure 2, the nozzle 26 may comprise three closely spaced parallel walls 26A so as to direct towards the seam two thin films of cool air. Alternatively, however, the nozzle 26 may direct a single film of air towards the seam and may be inclined to the centre line of the seam so as to cover the entire width of the seam.

By way of example, the hot air nozzle 10 may be one manufactured by Leister Elektro-Gerätebau, of 6056 Kägiswil, Switzerland, for example their device identified as the Leister Hot Air Tool 3000. The variable-speed blower, including a variable speed motor, may also be of a type offered by the same company.

The cold air nozzle or "air knife" may be of a type manufactured by Lechler. It may receive its air supply from the blower which supplies air to the hot air nozzle, so that the air velocity will also vary according to the bag material speed.

As shown in Figure 2, two non-metallic cheeks 32,34 are secured to the outside surfaces of both of the walls 20,22 forming the hot air nozzle. These cheeks prevent the packaging material from contacting the nozzle, for which purpose the outer edges of the nozzle walls are

recessed within the outer surfaces of the cheeks 32,34, which may be chamfered as shown in Figure 3.

Figure 3 shows the hot air nozzle in a retracted position allowing a pivoted cover plate 36 to be moved into line with the nozzle. This prevents hot air from the nozzle reaching the packaging material while the machine is temporarily stationary. The hot air gun is maintained at a constant working temperature even while the machine is temporarily stationary, and the blower may be kept running at a slow speed. The cover plate 36 is moved automatically, by a cam action, to the position in line with the hot air nozzle when the nozzle is retracted.

The bag-forming material may be drawn along the former 24, for example, by means of bands on opposite sides of the mandrel which may drive the material with the aid of suction applied through apertures in the bands. Alternatively, bands (possibly without suction) may be used to pull the material forward and maintain it in tension while the actual speed of the material is controlled by other means, for example rollers upstream of the former 24.

As shown in Figure 3, the longitudinal seam forming apparatus is mounted on a horizontal rod 38. It can be set at various positions along the rod, by means of a clamp 40, to accommodate formers of different sizes.

This invention may also be applied to an intermittent machine, that is to say one in which the web stops to allow intermittently moving sealing jaws to operate to form successive horizontal seals serving as the top of each bag and the bottom of the next bag. The blower is preferably arranged to run at a fixed low speed while the web is stationary, and at a higher variable speed while the web is moving; as before, the web speed preferably varies cyclically in a predeterminable pattern to achieve the desired (adjustable) bag length.

CLAIMS

1. A packaging machine of the type described, in which a web of bag-forming material (23) is driven downwards at a cyclically varying speed around a former (24) to overlap the edges of the web, and including a hot air device (10) for directing hot air onto the overlapping edges so as to seal them, characterised in that the hot air device (10) is supplied with air by a variable-speed blower (13) which automatically varies the velocity of the hot air directed towards the edges of the web, depending upon the speed of the web.

2. A machine according to claim 1, including means (26) for blowing cool air onto the seam downstream of the hot air device (10) to set the seam.

3. A machine according to claim 1 or claim 2, in which the web of packaging material (28) is driven continuously at a cyclically varying speed.

4. A machine according to claim 3, in which the blower speed is continuously variable so as to increase when the web speed increases and vice versa.

5. A machine according to claim 3, in which the blower is set to operate at two or more set speeds.

6. A machine according to claim 1 or claim 2, in which the web is arranged to be stopped at regular intervals while horizontal seals are made which form the top of each bag and the bottom of the next bag.

7. A machine according to claim 6, in which the hot air device includes a nozzle which is arranged to move away from the web while the web is stationary.

8. A machine according to claim 7, in which the blower is set to run at a fixed low speed while the web is stationary and at a higher variable speed while the web is moving.

9. A machine according to any one of claims 1 to 8, in which the hot air device (10) including an air heating device which is maintained at a constant but adjustable temperature.

10. A method of packaging products involving a machine of the type described, in which a web of bag-forming material is driven downwards at a cyclically varying speed around a former to overlap the edges of the web, and a hot air device is arranged to direct a stream of hot air onto the overlapping edges so as to seal them, characterised in that the hot air device is supplied with air by a variable-speed blower which automatically varies the velocity of the air directed towards the edges of the web, depending upon the speed of the web.

Fig.1.

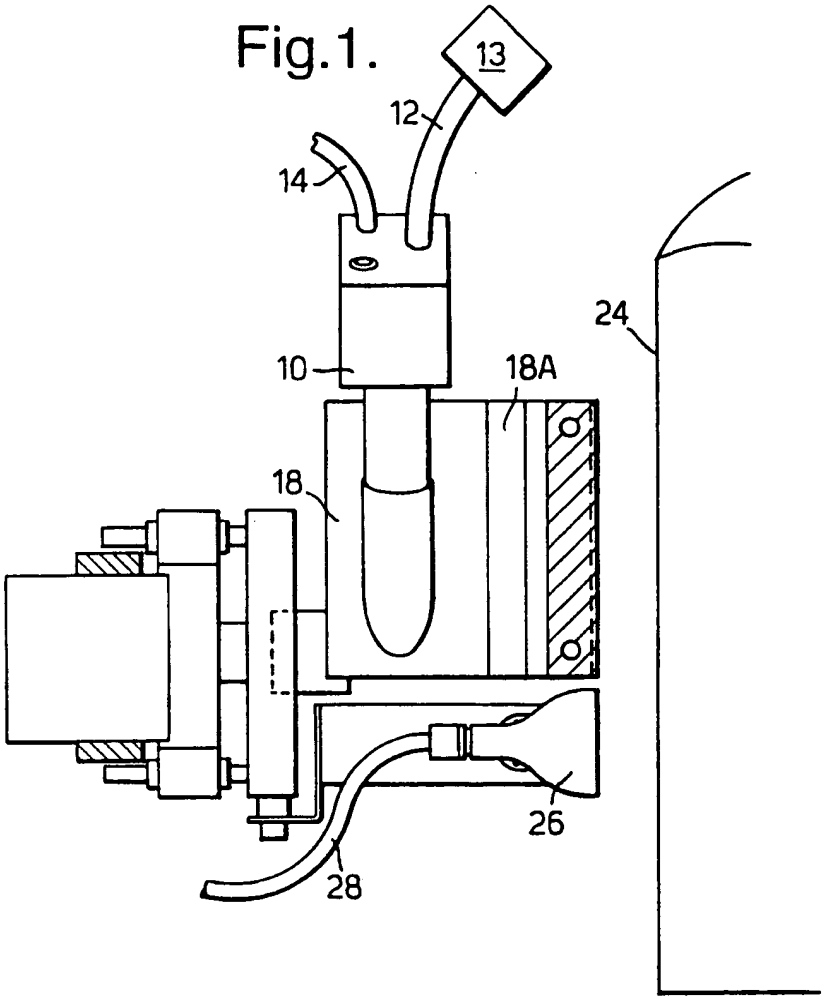


Fig.2.

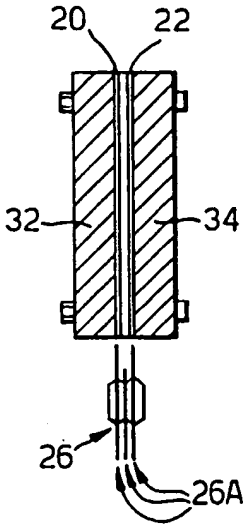
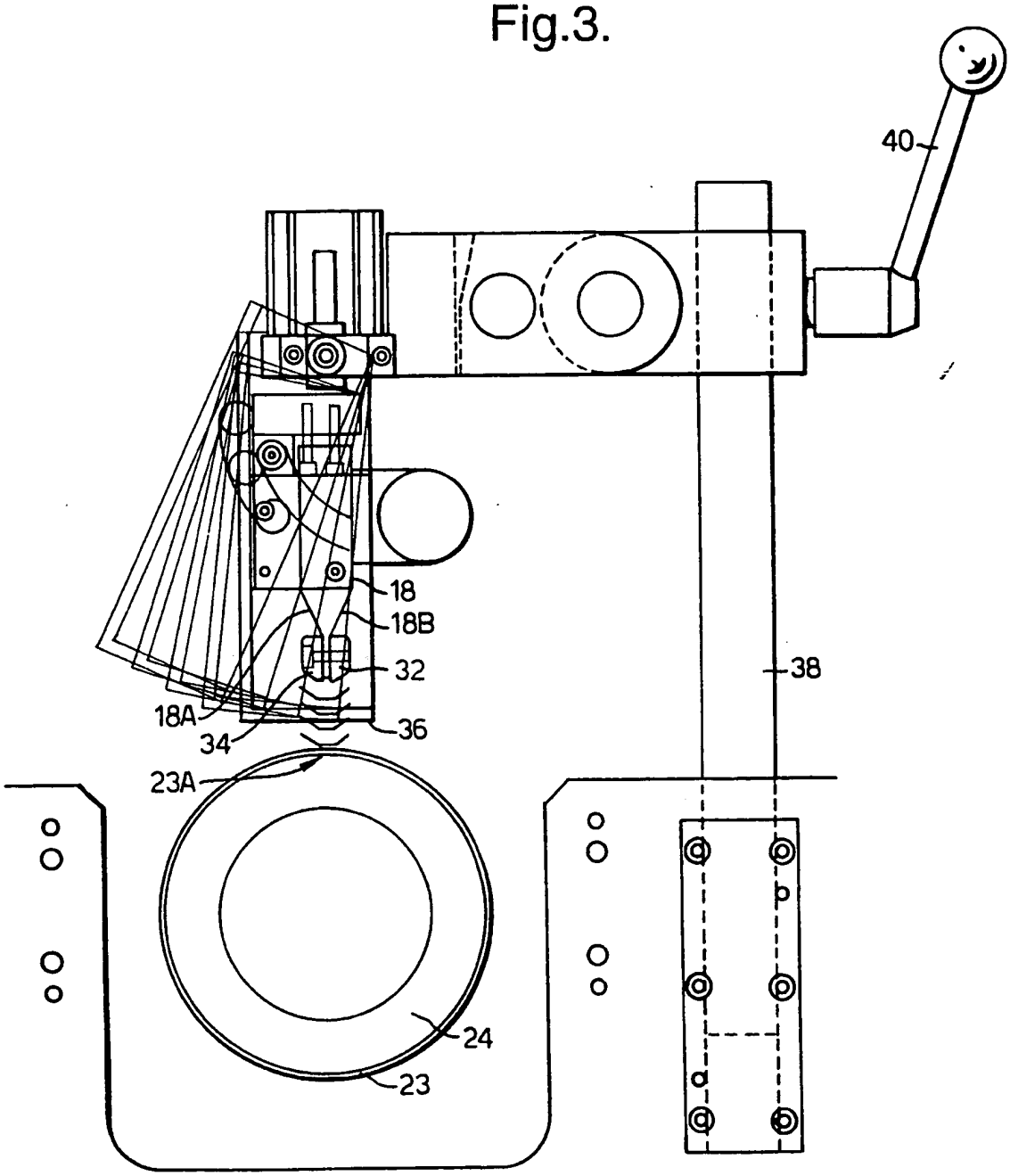


Fig.3.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/00666

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B29C65/10 B65B51/20

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B29C B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 218 863 A (HOWARD THOMAS B ET AL) 26 August 1980	1,2,9,10
Y	see column 8, line 47 - column 9, line 2	7,8
X	US 5 466 326 A (CHERNEY DALE M) 14 November 1995 cited in the application see column 1, line 27 - line 32	1,10
Y	GB 1 260 467 A (THE BRITISH SHOE MACHINERY COMPANY LTD.) 19 January 1972	7,8
A	see page 2, line 119 - line 122; claims see page 4, line 104 - line 107 see page 5, line 28 - line 35 see claims	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Category ³	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	CA 1 248 437 A (MOBIL OIL) 10 January 1989 see page 2, line 21 - line 23 see page 5, paragraph 2	1,10
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